

## REMARKS/ARGUMENTS

### *Status of the Application*

In the Final Office Action mailed October 1, 2007, claims 20, 21, and 25-31 were rejected. In the present response, claims 20 and 26 were amended to correct grammatical errors. No new matter was added.

### *Rejections Under 35 U.S.C. § 103(a)*

Claims 20, 21, 25-27, and 30-31 were rejected under 35 U.S.C. § 103(a) as being obvious over Kelley *et al.* (U.S. Patent No. 6,958,216) and Alivisatos *et al.* (Nature 382:609-11 (1996)). Applicants respectfully traverse these rejections.

In Kelley *et al.*, DNA is used

as a material of potential in molecular electronic sensor devices, being primarily based on molecular electron-transfer reaction processes between DNA-binding donors and acceptors. The  $\pi$ -stacked array of aromatic heterocycles at the core of the double-helical structure of DNA mediate strong electronic coupling between bound molecules. The integrity of the base stack of DNA is critical for efficient charge transport, as the presence of disruptions in  $\pi$ -stacking brought about by mis-paired bases or unpaired bases, and other external factors that perturb the base stack severely attenuates DNA-mediated reactions.

(col. 2, lines 10-21; emphasis added). The Kelley *et al.* sensor devices “utilize the capability of double-stranded DNA to conduct electricity, provides the means to measure the electrical conductivity, and more importantly, changes in electrical conductivity in short (<100 bp) and specific DNA sequences” (col. 2, lines 40-44; emphasis added).

Since single-stranded DNA has a considerable amount of structural freedom, the stacking in such a molecule should not promote electrical conductivity; only the substantially more rigid, double-stranded DNA molecules are capable of conducting electricity. Thus, if a single-stranded DNA molecule is used as a molecular wire between two electrical contacts, no conductivity would be measurable unless until a complementary strand of DNA hybridizes to the single strand to form a conductive duplex. Since only complete hybridization with a sensor strand results in electrical conductivity, the single strand of DNA that ‘wires’ together two electrical CNT contacts forms an extremely sensitive and highly selective electrical sensor.

(col. 3, line 59 – col. 4, line 4; emphasis added). Thus, while initial formation of the Kelley *et al.* DNA-CNT arrays involves single-stranded DNA, “‘wiring’ a pair of

neighboring spheres together is accomplished by subjecting the array to single-stranded sequences that are complementary to the different sequences on the two spheres” (col. 10, lines 6-10). The circuit is complete upon hybridization, thus forming double-stranded DNA between two spheres (col. 10, lines 10-11). While Kelley *et al.* speculates that “significant conductivity may be observed even for one double-stranded DNA connection between two beads, each connection is likely to be composed of hundreds of individual wires” (col. 10, lines 12-14; emphasis added). Because it appears that the examples in Kelley *et al.* are merely prophetic, the actual composition of the Kelley *et al.* DNA-CNT arrays is unknown. It does make sense, however, given the Kelley *et al.* figures showing multiple attachments of DNA to the spheres (see Figures 1, 5, and 7) and the method connecting DNA to a sphere (see col. 9, lines 5-31) that production of DNA-CNT arrays having a single DNA strand connecting two spheres would be quite unlikely.

Alivisatos *et al.* discloses “a strategy for the synthesis of ‘nanocrystal molecules’, in which discrete numbers of gold nanocrystals are organized into spatially defined structures based on Watson-Crick base-pairing interactions” (Abstract; emphasis added). Contrary to the Examiner’s assertion that the Alivisatos *et al.* “complexes are formed through the distal portions of the DNA ligands,” Figure 1 of Alivisatos *et al.* shows that none of the nanocrystal complexes are attached to each other at their distal portions (see arrows in the attached Appendix). Further, complete hybridization between the DNA template and the nanocrystal complexes appears to be necessary (see the figure legend for Figure 1 where 18-nt oligomers of the nanocrystal complexes are perfect complements to the 37- and 56-nt templates). Also apparently required is a DNA template that is not covalently attached to nanoparticles (see Figure 1). In contrast, Applicants’ inventions do not need any free DNA template for the formation of geometrical structures. The difference stems from the fact that Alivisatos *et al.* does not have one-particle-one DNA strand constructs as the building blocks.

Thus, both Kelley *et al.* and Alivisatos *et al.* teach perfectly complementary double-stranded DNA complexes. The presently claimed invention has no such complementation requirements. Indeed, as Figure 1(E) of the present application shows, DNA hybridization is not necessary and each nanostructure can retain a

single-stranded DNA molecule attached thereto. Further, neither reference addresses the requirement in the present claims of each nanoparticle-ligand complex being affixed to each other. In light of these differences between the cited references and Applicants' claims, and the fact that the Kelley *et al.* method of producing DNA-CNT arrays probably results in multiple DNA connections between each nanoparticle, Applicants respectfully submit that the skilled artisan would not have a reasonable expectation of success in developing the presently claimed inventions.

Claims 28 and 29 were rejected under 35 U.S.C. § 103(a) as being obvious over Kelley *et al.* and Alivisatos *et al.* in further view of Mirkin *et al.* (U.S. Patent No. 6,361,944). Because claims 28 and 29 are dependent claims, Applicants believe that the above traversal of Kelley *et al.* and Alivisatos *et al.* is equally applicable here. Applicants thus respectfully request removal of these obviousness rejections as well.

### **SUMMARY**

In view of the foregoing remarks, Applicants submit that this application is in condition for allowance. In order to expedite disposition of this case, the Examiner is invited to contact either of Applicants' representatives at the telephone numbers listed below to resolve any remaining issues. Should there be a fee due which is not accounted for, please charge such fee to Deposit Account No. 04-1928 (E.I. du Pont de Nemours and Company).

Respectfully submitted,

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